

DEFINING REGULATORY BOUNDARIES: NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM) IN THE OIL AND GAS INDUSTRY

Waste streams containing NORM at levels above background present a challenge to the oil and gas industry. As regulations governing the management and disposal of NORM-containing wastes evolve, the need to strike a balance between protecting human health and safety and minimizing the economic burden to oil and gas producers remains critical. EAD's analyses of the risks and regulatory and economic feasibility of disposal options provide valuable information to meet this need.

■ PROBLEM/OPPORTUNITY

Oil and gas production and processing operations sometimes cause NORM to accumulate at elevated concentrations in by-product waste streams. The primary radionuclides of concern are isotopes of radium that originate from the decay of uranium and thorium naturally present in the subsurface formations from which oil and gas are produced. The production wastes most likely to be contaminated by elevated radium include produced water, scale, and sludge.

Concerns about possible health risks arose in the mid-1980s. Since there were no federal regulations specifically addressing NORM management and disposal, states began establishing their own NORM regulatory programs providing exemption standards, licensing requirements, worker protection standards, and release criteria. The regulation established more restrictive standards for NORM waste disposal, which resulted in much higher waste management and site closure costs for the petroleum industry.

■ APPROACH

With funding from the U.S. Department of Energy (DOE National Petroleum Technology Office), EAD has been conducting studies to (1) identify issues related to NORM in petroleum

industry wastes, (2) evaluate potential risks associated with management and disposal options, and (3) demonstrate cost-effective site characterization and restoration approaches. A primary goal is to identify disposal options that would adequately protect human health and safety. A consideration is that increasing the number of options would probably result in lower waste management costs.

The NORM management and disposal activities being evaluated include options that have not been (or, at one time, were not) widely used because of regulatory or policy-based constraints. They include underground injection, salt cavern disposal, landspreading, disposal in nonhazardous landfills, and re-melting of contaminated scrap equipment. EAD has used a number of computer codes and analytical models developed by itself and others to assess radiological risks. It has refined the assumptions used to characterize NORM wastes and define disposal practices, leading to broader acceptance by regulators and the industry of the studies' results.

EAD has also been involved in demonstrating the applicability of the Adaptive Sampling and Analysis Program (ASAP) approach to NORM-contaminated sites. ASAPs rely on dynamic work plans to specify the decision-making logic that

guides data collection. They reduce costs by limiting the number of samples collected, reducing per-sample analytical costs, and eliminating multiple sampling program mobilizations. Their biggest advantage is their impact on the overall cost and effectiveness of remedial actions. Because the resulting data are so focused on remediation needs, the probability of inadvertently remediating soils that meet or exceed cleanup standards is minimized. If the benefits of this approach can be successfully demonstrated to the petroleum industry and its regulators, future site restoration costs may be reduced significantly.

■ RESULTS

EAD has developed a consistent methodology for evaluating potential radiological doses based on a variety of management and disposal activities. This methodology, and the computational models and assumptions used, have been documented in numerous publications and presentations.

■ COMMUNICATION OF RESULTS

More information about EAD's work on NORM issues, including access to relevant publications, can be obtained from EAD's website.
(web.ead.anl.gov)

EAD's findings indicate that most waste disposal options studied present negligible risk to the general public with respect to potential radiological doses. They also present negligible risk to workers, provided specific controls are implemented. By conducting sensitivity analyses on key parameters that have the most impact on risk, EAD has identified limiting conditions for some of the disposal options.

EAD's analyses have been conducted concurrently with the evolution of state-level NORM regulations. By focusing analyses on current and emerging NORM regulation issues, EAD has provided timely information to the industry and regulators.

■ FUTURE

EAD plans to form partnerships with other research organizations to continue identifying and evaluating NORM waste management issues for the petroleum industry. EAD will publish the results of ongoing and future studies as they become available.